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NMR-investigation of restricted self-diffusion of oil in rape seeds

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Abstract

The self-diffusion of oil and water in rape seeds (Brassica napus L.) was measured with the NMR pulsed field gradient technique. The self-diffusion of oil was found to be completely restricted for diffusion times Δ > 30 ms. The experiments could be explained in terms of the model of diffusion within spherical droplets and a Gaussian mass distribution of the droplet radii. The mean droplet radius was found to be about 0.7 μm; this value decreased somewhat with increasing moisture content of the seeds. The experiments could also be explained with a Gaussian number distribution of droplet radii and a fraction of immobile protons in the NMR signal of 5 ... 10%, possibly arising from lipid protons. Though the transverse nuclear magnetic relaxation decay of the oil protons is not a single exponential we observe one uniform diffusive mobility for the oil molecules. The water self-diffusion coefficient at maximum moisture content of about 40% was determined to be 4.2 · 10-10 m2 s-1 which is typical for swollen polymer-solvent systems at such a concentration. © 1990 Springer-Verlag.

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Keywords

NMR pulsed field gradient technique, Oil, Rape seeds, Self-diffusion